

Comorbidity of Internalising Disorders in Children and Adolescents with Low IQ:
An Item Response Theory Approach

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I declare that this thesis is my own work and that, to the best of my knowledge and belief, it does not contain material from published sources without proper acknowledgement, nor does it contain material which has been accepted for the award of any other higher degree or graduate diploma in any university.

Signed _____

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Abstract

The main purpose of the present study was to employ 2-parameter logistic item response theory modelling (2-PLM) to examine the internalising dimension, comprising diagnoses of common mood and anxiety disorders, within a low IQ (<80) child and adolescent population. This was done to investigate the validity of a dimensional approach to mood and anxiety comorbidity, as well as investigate the patterns of mood and anxiety comorbidity among a low-IQ population. Diagnoses were derived from interviews of 310 clinic-referred low IQ children and adolescents. The results of the present study suggested that all disorders were not only strong discriminators of the internalising dimension, but measured the dimension with more precision in the upper half of the trait continuum. The study also found support for the concurrent validity of the internalising dimension, referring to medium to large effect size associations with depression and anxiety scores of other measures. The implications for the study of comorbidity in this type of population, and the taxonomy of the mood and anxiety disorders in diagnostic manuals and conceptualisations are discussed.

Comorbidity of Internalising Disorders in Children and Adolescents with Low IQ: An Item Response Theory Approach

A wealth of research has found that anxiety and depressive disorders are often highly comorbid with each other (Mineka, Watson & Clark, 1998; Watson, 2005). Given that this rate of comorbidity is much higher than what would be expected by chance, statistical modelling techniques have been employed and reveal that these two types of disorders appear to load heavily on a single underlying factor or dimension (Krueger, Caspi, Moffitt & Silva, 1998; Lahey et al., 2008; Mineka et al., 1998; van Lang, Ferdinand, Ormel, & Verhulst, 2006; Watson & Clark, 2006; Widiger & Samuel, 2005). This dimension has subsequently been referred to as “negative affect” or “internalising” (Fergusson, Horwood & Boden, 2006; Krueger & Finger, 2001; McGlinchey & Zimmerman, 2007; Seeley, Kosty, Farmer, & Lewinsohn, 2011). As such, it has been proposed that rather than being separate and distinct disorders, the several types of anxiety and depression diagnoses may be indicators of this underlying dimension or latent trait (Krueger & Finger, 2001; McGlinchey & Zimmerman, 2007)..

Item response theory (IRT) approaches have begun to find evidence for this proposal, suggesting that anxiety and depressive diagnoses acting as indicators discriminate this underlying latent trait remarkably well (Krueger & Finger, 2001; McGlinchey & Zimmerman, 2007). Further, when individuals’ scores on this latent trait are correlated with measures of mood and anxiety symptoms, strong associations have been found (Krueger & Finger, 2001; McGlinchey & Zimmerman, 2007). This provides both validity and utility to the “internalising” conceptualisation. The findings also have implications for diagnostic nosology systems such as the Diagnostic and Statistical Manual of Mental Disorders (DSM), which views anxiety

and depressive disorders as separate and discrete entities. IRT investigations in this area, however, have only been applied to select populations. This is a limitation of the line of inquiry, and should be addressed in order to ascertain further support for the internalising dimension.

Low IQ populations have been established to possess increased rates of comorbidity of psychopathology, including anxiety and depressive disorders (Borthwick-Duffy, 1994; David, Zammit, Lewis, Dalman, & Allebeck, 2008; Goodman, Simonoff, & Stevenson, 1995; Gunnell, Harbord, Singleton, Jenkins, & Lewis, 2009; Lehotkay, Varisco, Deiraz, Douibi, & Carminatic, 2009). The patterns and nature of comorbidity among these populations, however, remain relatively overlooked (Dekker & Koot, 2003; Lehotkay et al., 2009; Ryland, Lundervold, Elgen, & Hysing, 2010; Weiser et al., 2004). Therefore, the focus of the current thesis will be to extend upon previous research and investigate the “internalising” dimension in a population of low IQ children and adolescents, utilising an IRT approach.

In terms of the structure of this thesis, a review of the literature will first take place. This will outline the relevant findings on the “internalising” dimension underlying anxiety and depressive disorders. Then, research regarding the association between low-IQ populations and increased rates of comorbidity will be reviewed. Finally, the present study will be described, which employs 2-parameter logistic item response theory modelling (2-PLM) to examine the internalising dimension, within a low IQ (<80) population of children and adolescents. The anxiety and mood disorders included in this study are Social Anxiety Disorder (SAD), Social Phobia (SOP), Specific Phobia (SPP), Generalising Anxiety Disorder (GAD), Obsessive

Compulsive Disorder (OCD), Post-Traumatic Stress Disorder (PTSD), and Major Depressive Disorder (MDD).

It should be mentioned that with the recent release of DSM-V, several of the anxiety and depressive disorders employed in this study have been reclassified. SAD, SOP, SPP, GAD are all presently considered as anxiety disorders. OCD and PTSD, however, are not. In DSM-V, there has been a new group of disorders labelled as Obsessive-Compulsive and Related Disorders that include OCD, and other disorders (Body dysmorphia disorder, trichotillomania and two new disorders called hoarding disorder and excoriation disorder). Meanwhile, PTSD is now categorised with other trauma and stressor related disorders (i.e. acute stress disorder and adjustment disorder). Lastly, regarding depressive disorders, DSM-V has combined MDD and Dysthymia (DYS) together under the category of persistent depressive disorders. As such, DSM-V suggests four groups (i.e. four factors) for the DSM-IV anxiety and depressive disorders. While this thesis will examine existing studies in terms of the organisation of these disorders in DSM-IV, the review of findings will be related to DSM-V where appropriate.

Comorbidity and the Internalising Dimension

Comorbidity of psychopathology, referring to two or more mental disorders co-occurring within the same individual at the same time, has long proved a fundamental challenge to clinical assessment and nosology (Angold, Costello, & Erknali, 1999). This is because the Diagnostic and Statistical Manual of Mental Disorders (DSM) which is the foundation for clinical diagnosis and assessment, is based on a neo-Kraepelinian model in which mental disorders are conceptualised and presented as discrete entities (Brown, Chorpita, & Barlow, 1998). Associated

findings that surround comorbidity and the large degree of diagnostic overlap of certain disorders, however, suggest the presence of shared core processes underlying these supposedly “distinct” disorders (Clark & Watson, 1991).

One set of disorders where this substantive overlap has been clearly documented is among mood and anxiety disorders. In child and adolescent clinic-referred samples, anxiety and depression are often co-occurring, with rates ranging widely from 32% (Kovacs, Gatsonia, Paulauskas, & Richards, 1990) to 62% (Masi, Mucci, Favilla, & Millepiedi, 2001). Similar rates have also been established in adult populations (Krueger & Markon, 2006). This high overlap of symptoms suggests that depression and anxiety disorders may not be separate entities, but instead underlying symptoms common to many disorders (Brown et al., 1998). These outcomes are also supported by a number of investigations employing various forms of statistical analysis. For instance, van Lang et al. (2006) investigated children with symptoms of anxiety and depression using latent class analysis to determine whether children with such symptoms could be categorised into homogenous groups. Results from their sample showed that only very few individuals had just anxiety or depression, and almost all (99%) had comorbid symptoms.

The substantial comorbidity and shared variance among mood and anxiety disorders is often explained in terms of a general “internalising” factor or continuous dimension (Lahey et al., 2008). Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) research in this area has supported a parsimonious single-factor representation of the internalising domain. For instance, Gomez, Vance, and Gomez (2013) used CFA to examine the factor structure of anxiety and depressive disorders in a sample of clinic-referred adolescents. The disorders examined in their study were SAD, SOP, SPP, Panic Disorder (PD), Agoraphobia (AG), GAD, OCD,

PTSD, DYS, and MDD. The models tested in the study included a 1-factor model encompassing all of the internalising disorders, a 2-factor model separating fear-related disorders (SAD, SOP, SPP, PD, AG, and OCD) from distress disorders (DYS, MDD, GAD, and PTSD), and another 2-factor model resembling DSM-IV classification, with anxiety disorders (SAD, SOP, SPP, PD, AG, GAD, OCD, and PTSD) on one factor and depressive disorders (DYS and MDD) on another. Results of the study showed good support for all 3 models tested. The correlations, however, between the factors in both the 2-factor models were substantial, and they lacked discriminant validity. These findings, indicating that internalising disorders are likely to share common core processes, provide strong support for a single factor representation of anxiety and depressive disorders.

Further support was found by Krueger, Caspi, Moffitt, and Silva (1998), when they examined the factor structure of a range of common depression and anxiety diagnoses in an adult population. This comprised MDD, DYS, GAD, AG, SOP, Simple Phobia (similar to SPP) and OCD. The authors found that a single factor structure was superior. In addition, when comorbidity patterns among disorders defined by the DSM-IV were evaluated, Lahey et al. (2008) also reported the superiority of a single factor representation of anxiety and depressive disorders. The model in their study was defined by a single general internalising domain which accounted for anxiety and depressive disorders, encompassing MDD, DYS, GAD, AG, SOP, simple phobia and OCD. A general externalising domain also attributed to other disorders in the study that comprised conduct disorder, marijuana dependence and alcohol dependence. Further evidence has been provided by other studies for the superiority of the single factor representation of the internalising dimension (Krueger & Finger, 2001).

This support among the research literature for a single factor appears to conflict with other conceptualisations. Most notably, the DSM-V has structured the common anxiety and depression diagnoses into a four different categories. This is based primarily on shared phenomenological features and has been similarly categorised in previous editions of the DSM. Even in studies that have supported two or more latent factors (Krueger & Markon, 2006) commonly separating the fear-related disorders from the distress disorders, these factors are often viewed as components of a single latent higher order internalising factor (Watson, 2005) which the research literature, as shown above, has supported.

Given the reviewed findings, the proposal has been put forward that instead of being discrete entities, anxiety and mood disorders are indicators of the single underlying “internalising” factor (Lahey et al., 2004). This may explain the common comorbidity found between these two types of disorders by suggesting that higher levels of the factor lead to higher levels of anxiety and depressive symptoms, and in turn, “diagnoses” (Seeley et al., 2011). In order to investigate these alternative dimensional conceptualisations of diagnostic co-occurrence, it is necessary to employ item-response theory approaches.

Item Response Theory

Item Response Theory (IRT) modelling refers to a class of psychometric procedures that can be used to quantitatively scale a set of observed indicators along a dimensional continuum representing an underlying latent construct (McGlinchey & Zimmerman, 2007). In the context of anxiety and depression and the corresponding internalising dimension, IRT can be used to scale the disorders (acting as diagnostic

indicators) along the “internalising” latent trait construct. This allows for the testing of the aforementioned proposal suggesting that anxiety and depressive diagnoses are indicators of this underlying dimension. This psychometric approach conveys meaning in terms of trait level (i.e. the degree of latent construct being measured) and in the properties of the items used to represent the construct (Reise & Haviland, 2005). The dimensional continuum representing the latent construct is scaled logistically or normally, expressed either in terms of logit or standard deviation units ranging from -3.0 to 3.0. In the case of mood and anxiety comorbidity, once a diagnostic interview is undertaken to assess depression and anxiety disorders and substantive comorbidity is observed linking these diagnoses together, then this should be reflected by significant positive correlations among all of the disorders. An appropriate model may then be applied to the data in order to assess and determine how the diagnostic indicators contribute to the measurement of the unobservable construct underlying them (Krueger & Finger, 2001; Reise & Haviland, 2005)

In assessing the relationship between responses to an item and the latent trait the item is supposed to be measuring, the model generates various IRT properties for dichotomous scores. Firstly, a graph called an item characteristic curve (ICC) is generated for each item showing the probability of a positive response to the item (positive diagnosis) as a function of the underlying trait (the location on the internalising dimension). For each item, the model also estimates the item’s difficulty (β) and discrimination (α) parameters. The difficulty parameter indicates the point on the scale of the latent trait where a person has a 0.5 probability of endorsing or responding positively to the item (diagnosis). The item discrimination parameter is the ability of an item to discriminate people with different levels of the underlying trait. Besides the ICC, difficulty and discrimination parameters, IRT models may

also generate item information curve (IIC) and test information curve (TIC). The IIC indicates the effectiveness or precision of an item to measure the latent trait at different levels of the trait continuum, while the TIC provides the effectiveness or precision of the test (all items together) to measure the latent trait at different levels of the trait continuum. The model further provides the latent trait scores for participants, based on their specific pattern of endorsements for the set of indicators in the model. In the present study, the use of IRT also allows the participant's scores on the internalising trait to be correlated with measures that may test the external validity of this construct. Other forms of statistical analysis are unable to perform this function.

Item Response Theory Approaches to the Internalising Dimension

There have only been two studies to date that have employed an IRT approach to investigating the internalising dimension underlying anxiety and depression comorbidity. Krueger and Finger (2001) initially employed this approach in a sample of 251 non-institutionalised U.S citizens aged from 15 to 54. Among the disorders used in their study were MDD, GAD, SOP, simple phobia, PD, AG and DYS. The results of their study showed that all of the disorders were strong discriminators of the underlying internalising dimension (high discrimination values) and were more representative of this dimension in the upper half of the trait spectrum (difficulty values above the mean level of the latent trait). In addition, the results of the study revealed that those possessing high scores on the latent internalising trait (meeting criteria for 6-7 disorders) were associated with increased social costs. This reflected a greater number of lifetime inpatient admissions for problems related to

mental disorder and number of days in the last 30 days the participant was unable to work or carry out normal (i.e. leisure time activities) because of a mental disorder.

McGlinchey and Zimmerman (2007) aimed to replicate the aforementioned study in a population of 2300 adult outpatients seeking psychiatric treatment. The disorders in their study were MDD, SOP, PA/AG, SPP and GAD. Like the previous study, the results supported a one-factor model which showed that the disorders were strong discriminators of the internalising dimension. They were also more representative of the dimension in the upper half of the trait spectrum. In addition, McGlinchey and Zimmerman found that participants' scores on the underlying trait were significantly associated with three other social cost measures: poorer social functioning, time missed from work and life time hospitalisations.

Both sets of investigators, however, recognised as a limitation that the findings of their studies applied only to the few populations employed. They subsequently encouraged further IRT analyses on differing clinical populations to continue investigations into the validity of the internalising dimension and extend the study of comorbidity. Currently, there has been no study examining the internalising dimension involving a cognitively impaired or "low IQ" population. This is important as among a specific type of population, such as those characterised by an intellectual disability or cognitive impairment, psychopathology, including anxiety and depressive disorders, has been established to occur at an increased rate. As such, an examination of the "internalising" dimension of this population would test the validity of the internalising conceptualisation, in addition to furthering the understanding of comorbidity among this type of population.

Cognitive Functioning and Psychopathology

Cognitive deficits have become an important focus for psychiatric research in many major psychiatric disorders. Converging evidence indicates that behavioural and cognitive dysfunction often coexists (Weiser et al., 2004). This comes from previous research, which has revealed cognitive impairments in schizophrenia (Bilder et al., 2000), affective disorders (Are-Vaidya et al., 1998), anxiety disorders (Mineka et al., 1998), personality disorders (Virkkunen & Luukkonen, 1997) and substance abuse (Bolla, Funderburk, & Cadet, 2000). Additionally, lower scores on measures of cognitive abilities have also been associated with higher rates of suicidal and homicidal behaviour (Gunnell et al., 2009). These findings are present across the lifespan in adults (David et al., 2008), and children and adolescents (Weiser et al., 2004).

Given this association, research has begun investigating risk and rate of psychopathology in populations specifically characterized by a lowered cognitive functioning/IQ. Studies have employed designs which make use of cohorts that have undergone both cognitive assessment and psychopathology screening. For instance, David et al. (2008) explored this line of inquiry in a sample of 52, 768 individuals aged 18-20 years conscripted for compulsory military training in Sweden during the years of 1969-1970. The investigators found that there was a general association between lower intellectual functioning and psychiatric disorder. Virtually all of the 9% of their sample who acquired a psychiatric diagnosis were associated with cognitive impairment, expressed in a significant lowering in IQ against the population average.

Further, Ryland et al. found that pre-school children with a full scale IQ (FSIQ) level between 70-84 had a significantly higher risk of acquiring a psychiatric disorder (including anxiety and mood disorders) than those children with a FSIQ over 85. This finding was in line with that of Dekker and Koot (2003) who showed that children with low IQ (FSIQs of 60-80) and those with moderate intellectual disability (FSIQs of 30-60) had a similar rate and estimated risk of mental health problems (including anxiety and depression) that was significantly higher than for children with a higher level of intellectual functioning.

Specifically, in the case of those populations characterised by an intellectual disability (generally an IQ below 70) research often states that these populations also suffer from greatly increased rates of psychopathology and poorer mental illness outcomes (Charlot & Beasley, 2013). Due to issues of inconsistency, however, regarding the definitions of mental illness used and sampling employed, these rates are shown as variable. For instance, in a review of the literature, Dykens (2006) found that the rates of mental illness in the intellectually disabled range from 10% (Borthwick-Duffy, 1994) to the mid-range of 30-40% (Einfield & Tongue, 2007) all the way up to as high as 70% (Ballinger et al., 1991). The author concluded that issues with diagnostic consistency, sampling, and measures employed clouded this area of literature but that evidence does support an increased vulnerability to mental illness. This was due to a majority of studies reporting average rates of 30-40% of intellectually disabled populations suffering from various forms of psychopathology.

With regard to anxiety and depressive conditions, it has been previously proposed that people suffering from intellectual disability may have limited awareness of or difficulty expressing inner emotional states given their lowered cognitive functioning. This may subsequently result in an inability to display and /or

report internalising symptoms and impair the detection of these conditions by assessment (Reiss & Valenti-Hein, 1994). Adding complexity to this issue is the relative lack of research in this area exploring the nature or examining how internalising disorders, specifically, present among these types of populations. In an attempt to investigate this line of inquiry, Dykens (2006) reported rates of anxiety and depression in the research literature, among those with mild intellectual levels of delay, to be as high as 22%. Stavrakaki and Mintsiouslis (1997) however, found that 27% of their sample of 257 intellectually disabled individuals was identified as suffering from varying anxiety disorders. These disorders were mainly seen in the mild and moderately intellectually disabled individuals of the population. Neither Dykens or Stavrakaki and Mintsiouslis though examined or included the comorbidity of internalising disorders; still a current limitation of this area of research.

This stated, some research has briefly begun to investigate the rate of comorbidity, inclusive of all forms of psychopathology in low IQ and intellectually disabled populations. It is an area of research, however, that is still in its infancy and as mentioned, while depressive and anxiety comorbidity has been included it has not been specifically examined. For instance, in a study by Lehotkay et al. (2009) it was found that up to 65% of their sample with intellectual functioning ranging from low/borderline (IQ: 70-84) to profound intellectual disability (IQ: <20) had two or more psychiatric diagnoses (including anxiety and depressive comorbidity). In addition, Emerson (2003) found that 19% of his sample with lowered and impaired cognitive functioning had two or more diagnoses, compared to the 6% without cognitive deficits, also using anxiety and depressive disorders.

In attempting to interpret the reviewed findings pertaining to an increased vulnerability to psychopathology, many authors have pointed to developmental

mechanisms, or more precisely, insults to neurodevelopmental processes. David et al. (2008), for instance, proposed that the association between low IQ/cognitive impairment and psychiatric disorder may reflect a “neurocognitive disadvantage”. David et al. defined this disadvantage as a subtle form of developmental or acquired disorder to the brain that may underlie inefficient information processing and also impaired emotional processing and social cognition. These elements are proximally related to psychiatric disturbances of all kinds. Similarly, inefficient information processing may lead to the misinterpretation of the actions of others, rigidity in dealing with stress, a restricted repertoire of coping strategies, failure to inhibit drives and failure to evaluate risk in terms of future adverse consequences. All of these putative psychological processes might lead plausibly to psychopathology, from psychosis through anxiety and depression, to substance misuse (David et al.). Consequently, these same elements would likely impair treatment outcomes.

In summary, however, this area of research is still in its infancy. The exact nature of comorbidity of mental illness within low IQ/intellectually disabled population has not been thoroughly explored. This specifically is the case with regards to anxiety and depressive disorders which have been found in general populations to co-occur at a rate greater than that expected by chance. The absence of research in effect may be due to previous claims surrounding difficulties with emotional expression among this population or the relative infancy of the research area as a whole. It is important, however, to investigate such a line of inquiry and any corresponding implications it holds for the study of comorbidity among those with lowered cognitive functioning/IQ.

The Present Study

As has been reviewed, growing evidence indicates a high degree of comorbidity between anxiety and depressive disorders. This has led to proposals regarding an underlying latent trait, referred to as “internalising”, representing shared core processes and features between these two types of disorders. As such, the common anxiety and depressive diagnoses may be more accurately considered indicators of this underlying trait. Studies employing IRT analyses have found support for the proposal as well as accumulating evidence for the external validity for this dimension (Beesdo-Baum et al., 2009; Higa-McMillan et al., 2008; Krueger et al., 1998; Krueger, Chentsova-Dutton, Markon, Goldberg, & Ormel, 2003; Krueger & Finger, 2001; Lahey et al., 2008; McGlinchey & Zimmerman, 2007; Seeley et al., 2011). There have, however, only been two IRT analyses to date in such an area, and they have been applied to a select population with the authors calling for subsequent analyses on varying populations to test the internalising conceptualisation.

Research literature currently examining the relationship between IQ and psychopathology has found that individuals who score low on this aggregate measure of cognitive functioning have an increased vulnerability to psychiatric diagnosis comorbidity, including anxiety and mood disorders (Borthwick-Duffy, 1994; David et al., 2008; Goodman et al., 1995; Gunnell et al., 2009; Higa-McMillan, Smith, Chorpita, & Hayashi, 2008; Kessler, Chiu, Demler, & Walters, 2005; Lehotkay et al., 2009; Virkkunen & Luukkonen, 1997; Weiser et al., 2004). Yet, this line of inquiry still appears to be in its infancy and the exact nature and patterns of the comorbidity among these types of population remain relatively overlooked.

As such, the purpose of the present study was to extend upon previous IRT approaches investigating the validity of the “internalising” dimension, and examine it

within a low IQ (<80) population. Therefore, the first aim of the present study is to use confirmatory factor analysis to examine the applicability of the 1-factor model for the internalizing disorders for a large group of low-IQ clinic-referred children and adolescents.

The disorders utilised in the present study are Separation Anxiety Disorder, Social Phobia, Specific Phobia, Generalising Anxiety Disorder, Obsessive Compulsive Disorder, Post-Traumatic Stress Disorder and Major Depressive Disorder. These disorders, while forming a larger list than those investigated in previous studies were not exhaustive of all internalising disorders. Limitations in this area were the result of the archived nature of the data-set, specifically that the disorder in question had a large enough frequency among the population for the statistical methods employed.

Contingent on support for a 1-factor model, the second aim of the study is to examine the IRT properties of the internalizing factor of this model using IRT. The third aim, depending on whether there was support for a 1-factor model, is to examine the external validity of the internalizing dimension. This will be done by examining the concurrent and discriminant validity of the internalizing dimension by correlating participants' internalizing traits scores (obtained through the IRT analysis) with the number of mood and anxiety disorders diagnosed and using internalising and externalising scores derived from other measures.

Method

Participants

Participants' data was collected via archive from the Academic Child Psychiatry Unit (ACPU) of the Royal Children's Hospital, Melbourne, Australia. The ACPU is an out-patient psychiatric unit providing services for children and adolescents with behavioural, emotional, and learning problems. Referrals are generally from other medical services, schools, and social and welfare organisations. For the current study, the records of children and adolescents aged between 4 and 18, referred between 2004 and 2010, who had been interviewed for clinical diagnosis were used. In all, the data of 310 participants was included. Participants' IQ ranged from 40-79. The average IQ of the sample was 69.53 ($SD = 8.69$). While all details are not provided here for the purposes of succinctness, most fathers of participants were employed, and the majority of mothers were either employed or performed domestic duties. More than two thirds of the sample had mothers and fathers who had attended secondary school and had families with an income less than 50, 000 per year. Table 1 shows the percentages of different disorders for the participants.

Table 1 - *Frequency and percentage of disorders*

	Frequency	Percentage
Separation Anxiety Disorder	66	21.3
Social Phobia	87	28.1
Specific Phobia	101	32.6
Generalized Anxiety Disorder	120	38.7
Obsessive Compulsive Disorder	75	24.2

Post-Traumatic Stress Disorder	55	17.7
Major Depressive Disorder	121	39

Measures

Anxiety Disorders Interview Schedule for Children (ADISC-IV; Silverman & Albano, 1996). The ADISC-IV is a semi-structured interview assessment, based on the DSM-IV diagnostic system. While the ADISC-IV is employed primarily to aid in the diagnosis of major anxiety and mood disorders, it can also be utilised for the diagnosis of other important childhood disorders and a variety of other behaviour problems. The ADISC-IV guidelines for diagnosis outline that a child be diagnosed of all disorders meeting criteria. Clinical diagnosis may result from either parent or child/adolescent interview, or from combining both interviews together if available. The diagnoses derived from the interviews of children were used for the IRT analysis. The Kappa values for interviews with children and adolescents, between 7 and 16 years, range from 0.61-0.80 (Silverman, Saavedra & Pina, 2001). The ADISC-IV has excellent test-retest reliability correlations for parent interviews ranging from .81 to .99 for internalizing disorders. Internal consistency correlations are also good, ranging from .81-.91. (Silverman et al.). It should be noted, however, that diagnoses in this study did not take into consideration the hierarchical exclusionary rules in the DSM-IV.

Achenbach System of Empirically Based Assessment (ASEBA; Achenbach & Rescorla 2001). The Child Behaviour Checklist – Ages 6-18 (CBCL), the Teacher Report Form (TRF) and the Youth Self-Report form (YSR) are part of the ASEBA.

The CBCL, developed for parents to complete has 113 items, while the TRF has 120 items for teacher completion. Both forms are used to evaluate and assess children between the ages of 4 and 18 years. The YSR, developed for the individuals under assessment to complete is aimed at those of 11 and 18 years of age and has 112 items, worded in the first person. The CBCL, TRF, and YSR all instruct respondents to evaluate the degree or frequency of each behaviour outlined in the item on a scale of 0 (not true), 1 (somewhat or sometimes true) or 2 (very true or often true). The standard rating period is 6 months for the CBCL and YSR, and 2 months for the TRF. All three of these scales have excellent test-retest reliability correlations, 0.95-1.00. Internal consistency of the subscales is also in appropriate ranges from .54 to .96 (Achenbach & Rescorla, 2001). Among other scores, these scales provide quantitative data for internalising behaviour problems and externalising behaviour problems. In the present study, these scores were used for the concurrent and discriminant validity analyses.

Wechsler Intelligence Scale for Children 4th Edition (WISC-IV; Wechsler, 2003). The WISC-IV provides a full scale IQ score, based on the aggregate of four composite index scores that reflect functioning along four cognitive domains, namely, the Verbal Comprehension Index (VCI), the Perceptual Reasoning Index (PRI), the Working Memory Index (WMI), and the Processing Speed Index (PSI). The VCI reflects performance across three verbal subtests (Vocabulary, Similarities, and Comprehension), whereas the PRI is a composite index based on performance on three visual reasoning subtests (Block Design, Matrix Reasoning, and Picture Concepts). The WMI and PSI are each based on two subtests, respectively, measuring auditory working memory (WMI: Digit Span, Letter-Number Sequencing) and speed of thinking and motor speed (PSI: Coding, Symbol Search). All scaled

scores and index scores were derived from raw scores based on the normative sample data (Wechsler, 2003). The WISC-IV has excellent reliability including full scale reliability test-retest correlations of .93. Internal consistency correlations among the subtests range from .76-.96 (Wechsler). Participants with IQ scores below 80 were used for the “low IQ” cut off, based on previous literature (David et al., 2008; Goodman et al., 1995).

Procedure

All the children and their parents whose data was used for the study participated in separate interviews and testing sessions with breaks as required over two consecutive days. Additional information from teachers was also gathered using the outlined checklists and questionnaires. In all cases, parental consent forms were completed prior to the assessment. The data that was collected covered a comprehensive demographic, medical (primarily neurological and endocrinological), educational, psychological, familial and social assessment of the child and their family. All of the data used in this study was collected by research assistants who were advanced doctoral students in clinical psychology or in child psychiatry under the supervision of registered clinical psychologists/ child and adolescent psychiatrists.

The research assistants were provided with extensive supervised training and practice by their supervisors prior to the collection of data. In particular, the training for the ADISC-IV included observations of it being administered by the psychologists and/or child and adolescent psychiatrists. The research assistants began administering the ADISC-IV only after they became skilled in its administration, as judged by the registered supervisors. There was adequate inter-rater reliability for the

diagnoses made between the research assistants and their supervisors, and between research assistants (kappa values generally more than .88).

Overall, standardised procedures were used for the administration of all measures. Additionally and where necessary, researchers read the items to participants who then completed their responses. Approximately 95% of the parent ADISC-IV interviews involved mothers only, and the rest involved fathers only or both fathers and mothers together. Clinical diagnosis was determined by two consultant child and adolescent psychiatrists who independently reviewed the data. The inter-rater reliability for diagnoses of the two psychiatrists was high for both the parent and child versions (kappa = .90).

Statistical Procedures

All the CFA analyses were conducted using Mplus (version 6.1) software (Muthen & Muthen, 2010), using the mean and variance-adjusted weighted least squares of WLSMV. This is a robust estimator recommended for ordered categorical data. Model fit was ascertained using the approximate fit indices of Root Mean Square Error of Approximation (RMSEA) and Comparative Fit Index (CFI). The guidelines suggested by Hu and Bentler (1998) are that RMSEA values close to 0.06 or below be taken as good fit, 0.07 to 0.08 as moderate fit, 0.08 to .10 as marginal fit, and >.10 as poor fit. For the CFI, values close to .95 or above are taken as indicating good fit, and values close to .90 and .95 are taken as acceptable fit.

This study used Multilog 7.0.3 (Thissen, 1991) to conduct the IRT analyses. For each diagnostic indicator (internalising disorder) the following psychometric properties were examined: ICC; (graphically), α , β , IIC (graphically). In addition, for

the overall internalising dimension, the TIC was also examined (graphically). For the ICC, IIC and TIC graphs, the x axis is the trait (0) scale range from -3.00 to 3.00, with mean = 0 and SD = 1. The latent trait scores for participants based on their specific pattern of endorsements for the set of disorders were computed here using expected a posteriori (EAP; Bock & Aitkin, 1981).

As the 2-PLM is model-based, it is necessary to test if there is model-data fit. This was assessed by an examination of the residuals (differences between the observed proportion and the model-based expected proportion of the responses in each category) provided by Multilog. As a result, low residual values indicate good model-data fit. Further confirmation of model-data fit were provided by fit plots derived from Modfit (Stark, Chemyshenko, Chua, & Wadlington, 2001) using the 2-PLM item parameters from Multilog.. When there is good model-data fit, the response curve for the observed data will correspond closely to the response curve predicted by the GRM.

The 2-PLM assumes unidimensionality and local independence. Local independence implies that associations between items are only caused by the underlying latent trait. Unidimensionality and local independence were examined using the confirmatory factor analysis (CFA) procedure for ordered-categorical data. Support for unidimensionality is inferred when there is good model fit, with significant and substantial factor loadings. Support for local independence can be inferred when no residual correlation is more than .20.

To examine the concurrent and discriminant validity the latent trait scores were correlated with the number of diagnoses endorsed, CBCL internalising and externalising problem behaviour scores, and TRF internalising and externalising problem behaviour scores. These analyses were conducted using the Statistical

Package for Social Sciences 21st Edition (SPSS). The effect sizes of these correlations were interpreted using the guidelines proposed by Hemphill (2003): correlations $<.2$ = small, correlations of $.2$ to $.3$ = medium and correlations $>.30$ = large.

Results

CFA Analysis: Support (fit) for the 1-Factor Model (Unidimensionality and Local Independence)

Table 2

Tetrachoric Correlations

	1	2	3	4	5	6	7
SAD (1)							
SOP (2)	.37						
SPP (3)	.22	.37					
GAD (4)	.40	.52	.38				
OCD (5)	.20	.39	.36	.335			
PTSD (6)	.44	.35	.35	.47	.21		
MDD (7)	.20	.38	.11	.54	.25	0.33	

Note. SAD = separation anxiety disorder; SOP = social phobia; SPP = specific phobia; PD = panic disorder; AG = agoraphobia; GAD = generalized anxiety

disorder; OCD = obsessive compulsive disorder; PTSD = post-traumatic stress disorder; MDD = major depressive disorder.

Firstly, support for a 1-factor model, in terms of the fit of the model, was tested. Table 2 presents the tetrachoric correlation matrix between these disorders. As shown, the disorders were all significantly positively correlated ($p < .001$). The specific fit values for the 1-factor model were WLSMV ($df = 13$) = 11.976, $p = 0.52$; RMSEA = .000; CFI = .1.00, and. the residual correlations for the model ranged from .00 to .14. All of these figures suggest good model fit. It was also found that all the factor loadings were also significant and high, ranging from .48 to .79. As such, taken together, these findings can be considered as indicating acceptable support for the unidimensionality of this model and the local independence of the disorders in this model.

2-Parameter Logistic Item Response Model-Data Fit

MULTILOG indicated that the residuals (differences between the observed proportion and the expected proportion of the responses in each category) for the disorders ranged from .00 to .001. This suggests good model-data fit for the 2-PLM in this study.

IRT Analysis: 2-Parameter Logistic Item Response Model

Table 3

Two-Parameter Logistic Item Response Model Parameter Estimates (N=310)

SAD	SOP	SPP	GAD	OCD	PTSD	MDD
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α : Estimate	1.03	1.55	0.92	2.33	0.90	1.32	1.12
<i>SE</i>	0.23	0.27	0.20	0.36	0.21	0.27	0.20
β : Estimate	1.53	0.86	0.93	0.35	1.47	1.52	0.50
<i>SE</i>	0.30	0.15	0.23	0.09	0.33	0.25	0.16

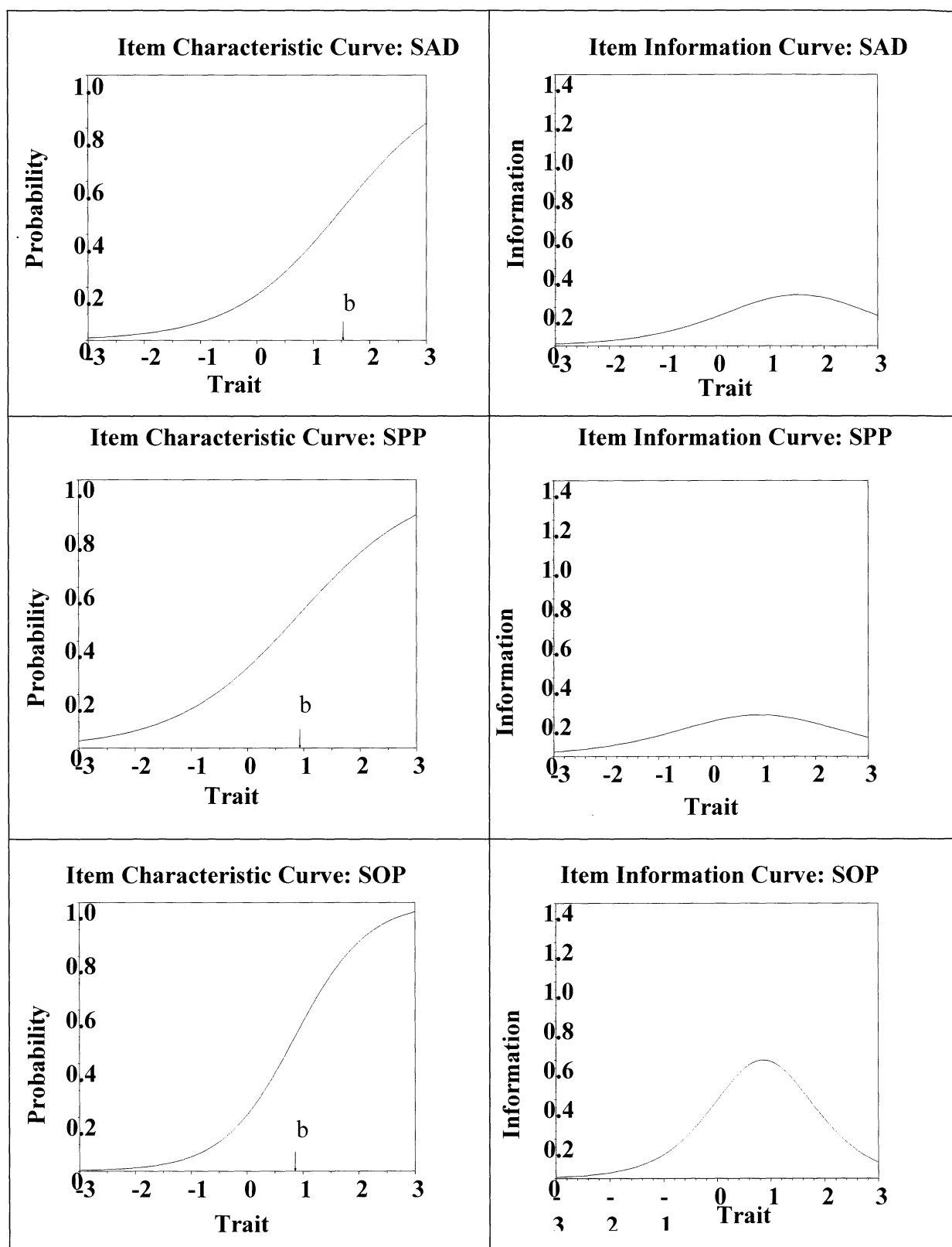
Note. SAD = separation anxiety disorder; SOP = social phobia; SPP = specific phobia; PD = panic disorder; AG = agoraphobia; GAD = generalized anxiety disorder; OCD = obsessive compulsive disorder; PTSD = post-traumatic stress disorder; MDD = major depressive disorder.

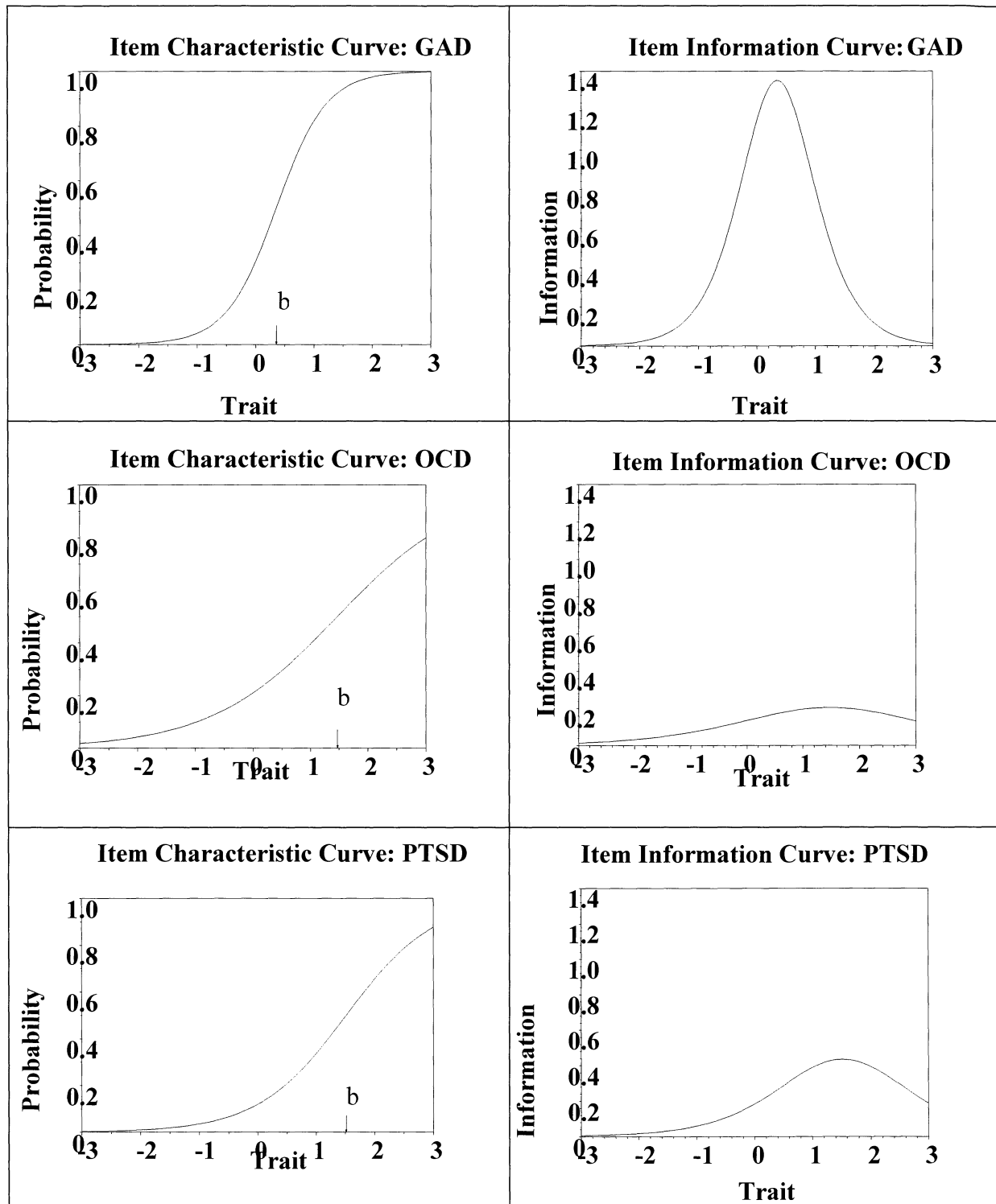
The α and β parameters (discrimination and difficulty values, respectively) from the 2-PLM for the disorders are provided in Table 3. Figure 2 shows the ICCs and the IIC curves for these disorders and also the TIC curve for this analysis. In regards to the capacity of each disorder to discriminate the underlying trait, the α values for all disorders were high ($>.85$; see also Figure 2) thereby suggesting that each disorder was good at this discrimination function. The order in terms of increasing discrimination values were OCD, SPP, SAD, MDD, PTSD, SOP, GAD. However, the discrimination values were comparable across all disorders (between 0.90 and 1.55) except GAD (2.33). This suggests GAD as the disorder most effective at discriminating the underlying internalising factor.

As mentioned previously, the difficulty values represent the point on the underlying internalising factor where an individual has a 50% probability of endorsing that diagnosis. In regards to the present study, all disorders except GAD and MDD were located close to or above the mean trait level. Interestingly, these two disorders were below the mean trait level suggesting that individuals in our sample who endorsed another diagnosis were also more likely ($>50\%$) to have

endorsed one or both of these diagnoses as well. The order in terms of increasing difficulty values were GAD, MDD, SOP, SPP, OCD, PTSD, SAD. The difficulty values were comparable across GAD and MDD (0.35 and 0.50 respectively), SOP and SPP (0.86 and 0.93, respectively) and OCD, PTSD, and SAD (1.47, 1.52 and 1.53 respectively).

The TIC graph (see Figure 2) illustrates that for the internalizing trait as a whole, the values were relatively low to approximately the mean trait level. This is likely to reflect that most of diagnostic indicators provided little information about the lower end of the trait among our population. From this point onwards, however, they were relatively high, suggesting they were strong indicators of the upper half of the factor. In terms of how much information was provided by each of the disorders to the internalizing trait, the IIC graphs (see Figure 1) illustrate that GAD and SOP contributed relatively more information to the internalizing dimension than SAD and PTSD which both contributed relatively more information than MDD, OCD and SPP. In addition, with the exception of GAD and SOP, the IIC values for all other disorders were very low to around the mean trait level.





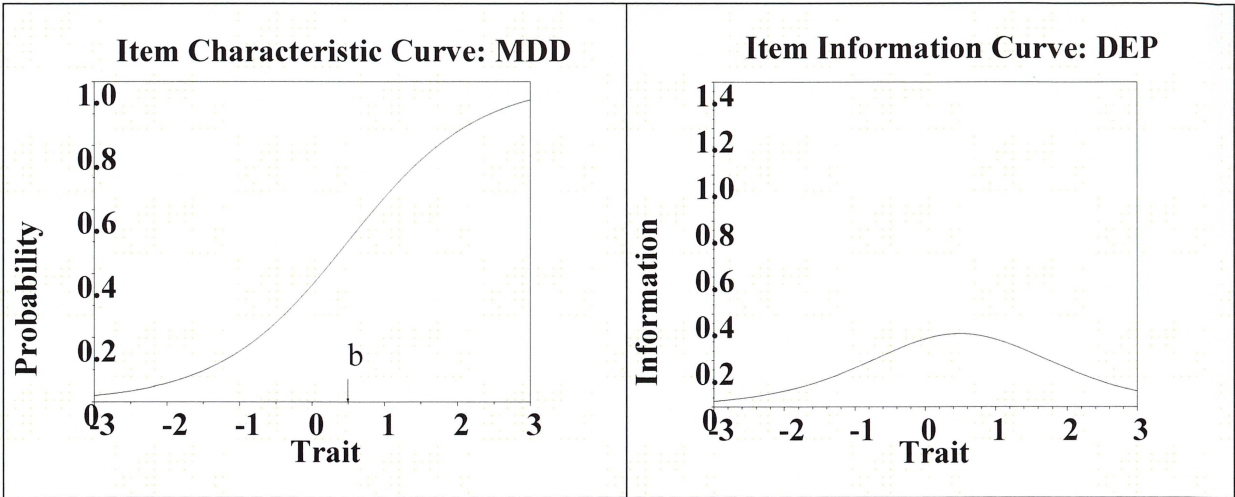


Figure 1 – ICC (left) and IIC (right) for all disorders in the following order: SAD, SOP, SPP, GAD, OCD, PTSD, and MDD.

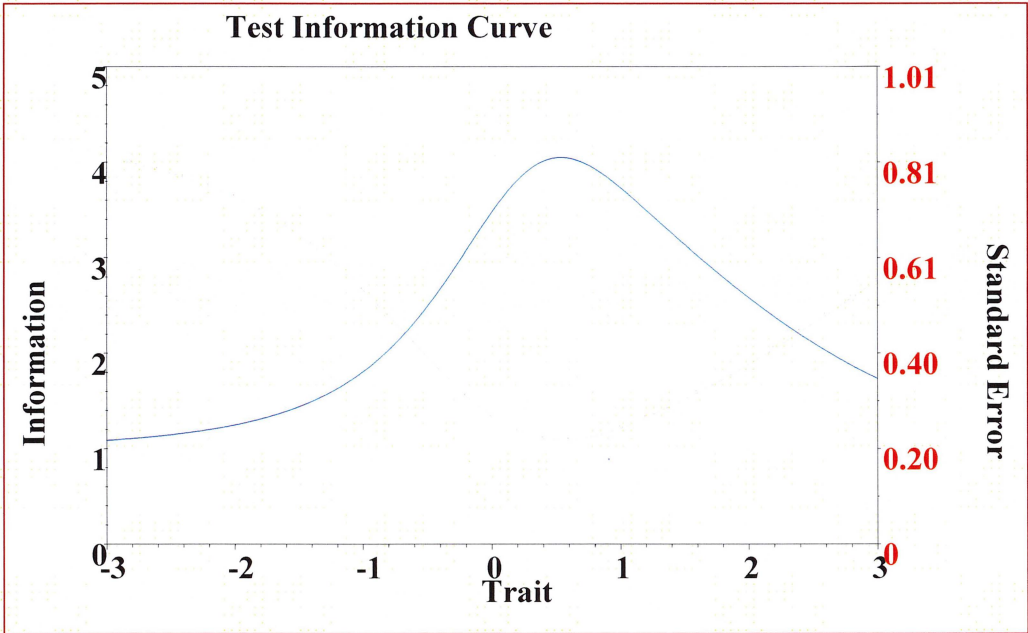


Figure 2 – Test Information Curve (Blue Line) And Standard Error Curve (Red Line)

**Concurrent and Discriminant Validities of the Internalising Factor:
Correlations**

Correlation analysis indicated that the EAP scores were highly correlated with the number of diagnoses ($r = .92, p < .001, N = 310$). They were also significantly correlated with the internalising scores of the CBCL ($r = .51, p < .001, N = 310$) and the TRF ($r = .241, p < .001, N = 195$). Based on guidelines suggested

by Hemphill (2003), all of these correlations were of large or medium effect sizes. These findings are supportive of the concurrent validity of the internalising latent dimension or factor. In terms of discriminant validity, correlations with the externalising scores, results were not as supportive. While the correlation between the EAP scores and the externalising scores of the TRF was negative and non-significant ($r = -.042$, $p = .559$, $N = 195$), the correlation analysis between the EAP scores and the externalising score of the CBCL was small and positive ($r = .141$, $p < .05$, $N = 310$). See Appendices A-E for SPSS output (including descriptive statistics).

Discussion

The main aims of the current study was to employ an IRT approach in the examination of the internalising dimension underlying mood and anxiety disorders in a group of low IQ clinic-referred children and adolescents. This allowed for the validation of the dimension among this type of population and an exploration of the patterns of comorbidity among this type of population too. The anxiety and mood disorders under investigation were SAD, SOP, SPP, GAD, OCD, PTSD, and MDD. Firstly, a CFA conducted on the data indicated support for a one factor model, and the assumptions of local independence and unidimensionality for the disorders were maintained. This support for a one factor model has been found in previous studies using both adult populations (Krueger et al., 1998; McGlinchey & Zimmerman, 2007) and the relatively new area of research employing adolescent populations (Gomez, Vance & Gomez 2012). This is, however, the first study that is known of to find it among a low IQ population.

Next, the findings of the IRT analysis revealed that all disorders had high α values, supporting the notion that they were all strong discriminators of the internalising dimension. In terms of β values, all disorders, with the exception of GAD and MDD were located close to or above the mean trait level. This indicates that most of the disorders under examination in the present study were more representative of the internalising dimension in the upper half of the trait continuum. These findings were as hypothesized, and are consistent with the two previous studies involving adults (Krueger & Finger, 2001; McGlinchey & Zimmerman, 2007). A further general finding surrounded the TIC values being much higher in the upper half of the internalizing trait continuum. The findings infer that the disorders, as a whole, provided more measurement precision in the upper half of this trait continuum but not the lower half. These findings are also consistent with the three aforementioned studies. Lastly, the findings clearly illustrate that most of the disorders possessed IIC values that were very low to approximately the mean trait level. The main exceptions here were GAD and SOP, suggesting that all other disorders had less precision below their mean trait level.

While the findings reported displayed a minimal representation and measurement precision below the mean trait levels, this is as to be expected. Reise and Waller (2009) have explained that clinical constructs (i.e. internalising diagnostic indicators) have a quasi-trait status. This means that much of their traits are represented at the higher and more severe end of their continuum. As such, a clinical construct will have less representation and therefore precision at the lower end of its trait continuum. With regard to this, psychometrically, low representation and precision of the internalising construct is of little importance to a clinical perspective.

As mentioned, the α values illustrate the strength of association of the indicators with the underlying latent factor. While the reported findings show that all of the disorders had high α values, inferring strong associations with the internalising factor, a further examination of these values reveal a noteworthy finding. OCD, SOP, and SAD (which all had an approximately equal association with the latent factor) were not as strongly associated as the other diagnostic indicators. Furthermore, of these remaining diagnostic indicators MDD, PTSD and SPP (which again, all had approximately equal associations with the latent factor) were not as strongly associated as GAD that had the highest association of all of the disorders. This does make sense given that the disorder, characterized by a "general" anxiety that impairs many areas of life and functioning is most strongly associated with a trait that reflects variance common to all anxiety and mood disorders.

Another noteworthy finding is revealed by an examination of the β values, which have implications for the understanding of the comorbidity of different mood and anxiety disorders in our sample of low IQ children and adolescents. The β values for GAD and MDD were close to 0.5 SD below the mean; SOP and SPP were around the mean, and OCD, PTSD, and SAD were around 1.5 SD above the mean. Consequently, these values infer that GAD and MDD are closely comorbid with each other, SOP and SPP are closely comorbid with each other and that OCD, PTSD, and SAD are closely comorbid with each other. With regards to the finding surrounding the close comorbidity of GAD and MDD, the research literature does appear quite consistent in general and other specific populations. Often GAD and MDD have been found to co-occur at a greater rate than other anxiety and mood disorders and have also at times been conceptualised as very similar disorders (Seeley et al., 2007).

In terms of the concurrent and discriminant validity analyses, psychometric support for the internalising factor was revealed. The participants' EAP scores had a very significant and strong positive correlation with the number of diagnoses endorsed. Additionally, these scores had large and medium effect sizes with the internalising scores of the CBCL and TRF, respectively. In addition, the correlation analysis between participants' EAP scores and the externalising scores of the TRF were not significant, suggesting some support for discriminant validity of the dimension in this population. It should also be mentioned, however, that the correlation with the CBCL externalising scores was positive and significant, yet quite small. It is unknown why this was the case but should be taken under consideration in evaluation of the discriminant validity of the internalising dimension in a low IQ population. In terms of the support for the concurrent validity of this dimension, previous findings by the prior studies in this area have been consistent with what has been found in the current study and do provide strong support for the conceptualisation of the internalising dimension with some potential differences in a low IQ population (Krueger & Finger, 2000; McGlinchey & Zimmerman, 2007; Gomez and Vance).

Theoretical Implications

The results and corresponding interpretations made in the present study have a number of implications for the taxonomy and diagnosis of mood and anxiety disorders in general, as well as for the study of anxiety and depressive comorbidity in a low IQ population. Firstly, the CFA support found for a one-factor model is consistent with the proposal put forward in the research literature that anxiety and

mood disorders can be categorized together in a single group and psychometrically, along a single dimension or factor (e.g. Krueger 1999; Mineka et al., 1998; Watson, 2005). As mentioned in the introduction to this thesis, several studies have found that the anxiety and mood disorders load heavily onto a single factor, and while others have found two factors, there is often a higher order/superordinate internalising factor involved.

Further, the findings of this study provide additional support for the validity and clinical utility of the internalising dimension. As mentioned above, participants with higher EAP scores had higher internalising scores on both the CBCL and the TRF - both psychometrically valid anxiety and depressive assessment instruments. The EAP scores also had a strong and significant positive association with the numbers of diagnoses endorsed. This is both consistent with previous research literature and with the notion that individuals who have higher scores on this internalising trait, as a consequence, are likely to possess more anxiety and depressive diagnoses.

The single factor conceptualization is in contrast to the current organisation of anxiety and depressive disorders in the DSM-V which have categorised these disorders under four different groups based on shared phenomenological features. Researchers who have undertaken previous IRT and EFA/CFA studies have suggested that the mood and anxiety disorders be grouped under an overall category called “internalising disorders”. In this category effectively, the different mood and anxiety disorders would be arranged in a form or manner that reflects their degree of severity along the internalising dimension as put forward by research in the pertaining area (McGlinchey & Zimmerman, 2007; Krueger & Finger, 2001). The results of the current study provide support for this proposal.

As mentioned, the findings of the current study also add to the limited, but increasing research literature on the nature of internalising disorders and comorbidity among low IQ populations. The results suggest that the “internalising” conceptualisation of comorbidity possesses substantial utility in this type of population, as it does with regard to the general and out-patient populations to which it has been previously employed. This is an important finding, given that previous literature has been somewhat conflicted in regards to the presence of anxiety and depressive disorders in this type of population. The fact that a number of the common internalising disorders were not only present among this population but also correlated with each other does suggest that anxiety and depressive comorbidity is a real concern for individuals who suffer from cognitive impairment. To be able to provide an alternate dimensional understanding to a population that suffers from this risk is beneficial.

Specifically, the findings of the current study when compared to findings of the previous two IRT studies reveal noteworthy similarities and differences, that hold implications for the assessment and diagnosis of low IQ and intellectually disabled populations. The most substantial of these regards GAD. In the previous two studies by Krueger and Finger (2001) and McGlinchey and Zimmerman (2007), GAD was found to have a difficulty value of 1.03 and 1.29 respectively. Yet in the present study, GAD possessed the lowest difficulty value of 0.35; close to the mean level of the trait. As such, within our low IQ population, the point on the latent internalising trait where individuals had a 50% chance of endorsing a GAD diagnosis was much lower than the previous two populations. Consequently, individuals in our population who possessed higher scores on the internalising latent trait reaching/surpassing the difficulty values for other internalising disorders, had an

even greater probability of also endorsing a GAD diagnosis. Furthermore, GAD possessed a very high item information function (See appendix B). In this instance, the item information function indicates the range of the internalising trait where GAD is best at discriminating among individuals. This disorder, as such, possesses high precision (reliability) in measuring the underlying internalising trait, particularly the upper half among this population.

Whether this finding is characteristic of other low-IQ populations requires further replication and study. It does suggest though that when an assessment is undertaken on this type of population, GAD could constitute an initial disorder for diagnosis. The presence of this disorder may suggest that an individual is located above the mean on the underlying internalising trait and has a higher probability of endorsing other internalising disorders. Conversely, the presence of other disorders may increase the likelihood that an individual could also endorse a diagnosis of GAD. It should too be noted here that MDD in the present study possessed a difficulty value of .50, slightly above GAD (.35). While it is suggestive that MDD could be used as an initial disorder for diagnosis, given its close comorbidity with GAD in the present sample, this disorder did not possess the same precision (as shown by the item information function). Therefore, caution should be exercised.

In terms of comparisons between the present and past studies there were also notable similarities. For instance, in the present study the difficulty value for MDD was found to be .50 while McGlinchey and Zimmerman (2007) found a difficulty value for MDD slightly under that of 0.28. Additionally, in the present study SOP was found to possess a difficulty value of 0.86 which it also did in Krueger and Finger's study and was in a similar range to that found in McGlinchey and Zimmerman's study of 1.05. Lastly, in the present study SPP possessed a difficulty

value of 0.93, and the related disorder of Simple Phobia was found to possess a score of 0.824 in Kruger and Finger's study. These comparisons would suggest that the probability of endorsing these internalising disorders as a function of the underlying internalising trait in our low-IQ population were similar to those found previously in other populations.

Overall, these findings begin to explore the nature of internalising disorders among those with a low IQ. This is the first study to date that has attempted an investigation of this kind. Furthermore, these findings are consistent with previous reviews and studies such as those by Dykens (2007) and Stavrakaki and Mintsoulis (1997) which have shown that anxiety and mood disorders are a concern for individuals who may suffer from lowered cognitive functioning. Additionally, the findings of the present study also present a way of conceptualising the comorbidity of anxiety and depressive disorders among this population utilising the internalising dimension. Specifically, the threshold values in this study would suggest the following order of increasing severity in our low-IQ population: GAD, MDD, SOP, SPP, OCD, PTSD, SAD. As such, it may be of benefit to consider this order when undertaking clinical diagnosis and assessment among those with cognitive impairment/intellectual disability. In addition, GAD in particular, could be constituted as an initial disorder given it possesses the lowest threshold value of the disorders and high information value.

In regards to clinical practice, the association between anxiety and depressive disorders as indicators of the underlying internalising dimension highlights the necessity for a comprehensive evaluation of the entire internalising dimension. This will allow for a better understanding of psychopathology among a low IQ population. The findings of the present study would also imply that treatment may have to target

general distress, with special focus on the range of associated abnormal anxiety and fear responses rather than the individual disorders. This has been previously suggested by Gomez, Vance, and Gomez (2014). As such, recently developed transdiagnostic treatment approaches for anxiety and depression disorders in children and adolescents may be appropriate for this (Ehrenreich-May & Bilck, 2012). This is because transdiagnostic approaches focus on common factors that produce symptoms in related classes of disorders, such as anxiety and depression, thereby addressing multiple concerns or disorders within an individual (Ehrenreich-May & Bilck).

Limitations and Directions for Future Research

There were some limitations of the current study that should be mentioned. First and foremost, the pattern, incidence, age of onset, gender, progression, stability and comorbidity of the mood and anxiety disorders are different across children, adolescents and adults, and most importantly, IQ range. These were not controlled for in the present study. As such, caution should be taken in generalizing these findings to other populations. Secondly, a number of the participants in the current study had other externalising disorders such as ADHD or CD/ODD or both. As this was not controlled for, there is some uncertainty as to whether this held any influence on the findings. Next, all of the children and adolescents who participated in this study were from the same clinic. Therefore, this may have constituted an additional bias from the sample examined, which limits the findings and interpretations made in this study. A further consideration is that the sample in this study investigated the internalising dimension in clinic-referred children and adolescents and caution should be taken in generalising findings to children and adolescents from the general community.

Given the aforementioned limitations, there is a need for replication and cross-validation of the findings outlined here before they can be generalised, particularly in low IQ populations. This study marks an initial step in investigating patterns of comorbidity in these types of populations with a great deal more research and investigation necessary to provide clinically useful implications and recommendations. In making suggestions for future studies, the examination of samples from several clinics and from the general community appears to be most important. In addition, investigation into the internalising dimension in an adult population with cognitive impairment may also be of benefit to examine any age-base differences among this type of population. In addition, given that in the present study GAD was found to possess IRT properties that were different to both the findings of previous studies and other disorders in the present study, future IRT studies could be employed to determine whether this is characteristic of a low-IQ population.

Conclusion

The aim of the present study was to investigate the “internalising” dimension proposed to underlie the major anxiety and mood disorders, in a sample of low IQ children and adolescents. This was examined through employing an IRT approach, allowing the scaling of disorders (acting as diagnostic indicators) along the “internalising” trait construct and exploring their 2-PLM parameters. Additionally, the participants’ individual EAP scores were then correlated with a series of depressive and anxiety measures to provide further psychometric validation. Previous research into the internalising dimension has found not only support for the

single higher order factor through CFA studies, but also psychometric support in the form of concurrent and divergent validity illustrated through associations with amount of diagnoses, depressive and anxiety assessments and measures of social burden. The examination of the dimension in a low-IQ population, where increased rates of mental illness have been found, allowed for further support of the validity of internalising factor.

Support was found in the present study for the superiority of the one-factor model of “internalising”, a finding consistent with previous research. An IRT analysis was conducted, and the respective parameters were examined which showed positive results. Overall, the disorders were both strong discriminators of the internalising dimension and had varying difficulty values. Further to this, the participants’ individual EAP scores were found to strongly and positively correlate with the number of diagnoses endorsed, as well as large and medium correlations found with the internalising dimensions of the CBCL and TRF. The EAP scores also did not correlate with the externalising dimension of the TRF, providing some divergent validity. There was, however, a significant yet small, correlation with the externalising dimension of the CBCL that was of some concern and should be considered in the interpretation of the results reported here.

This research possesses important implications in terms of the organisation and categorisation of depressive and anxiety disorders in diagnostic and statistical manuals, as well as for the study of comorbidity into low IQ populations. As mentioned above, the results of the study provide more support against the use of the neo-Krapelinian model, and instead, support for the conceptualisation of anxiety and mood in a dimensional context. The present study also adds to the small amount of literature on the nature of comorbidity of psychopathology and low IQ populations.

Of note, GAD was found to possess a difficulty value just above the mean level of the trait, as well as a high item information function. Consequently, this disorder among our low-IQ population had very high precision in measuring the underlying internalising trait and could constitute an initial disorder for assessment and diagnosis among cognitively impaired populations.

The present study also possessed a number of limitations that could be addressed by future studies. These comprised variabilities in the pattern, incidence, age of onset and variability of comorbidity. A significant aspect was that the low-IQ sample in the present study consisted of children and adolescents. As such, replication and cross-validation studies should be undertaken on other low-IQ populations in order for this to be addressed. Additionally, the current study consisted of individuals possessing a low-IQ, that ranged from borderline cognitive functioning (IQ: 70-80) to moderate and severe levels of intellectual disability. This may have also affected the results in various ways. Future studies could address the aforementioned limitations by employing a number of different samples varying characteristics (i.e. age, IQ level, gender) to determine any differences in results across these variables. Further to this, future studies could also focus specifically on the nature and manifestation of anxiety and depressive comorbidity, such as GAD, among low-IQ populations to determine whether there are differences in disorder presentation than that seen in normal cognitively functioning populations.

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Appendix A - Correlation Analysis of Internalising Trait Scores & Internalising Subscale of CBCL

Descriptive Statistics

	Mean	Std. Deviation	N
Trait	.06	.729	310
Internalizing- t score	66.83	10.289	310

Correlations

		TRSCIRT	Internalizing- t score
Trait	Pearson Correlation	1	.514**
	Sig. (2-tailed)		.000
	N	310	310
Internalizing- t score	Pearson Correlation	.514**	1
	Sig. (2-tailed)	.000	
	N	310	310

** . Correlation is significant at the 0.01 level (2-tailed).

Appendix B – Correlation Analysis of Internalising Trait Scores and Externalising Subscale of CBCL

Descriptive Statistics			
	Mean	Std. Deviation	N
Trait	.06	.729	310
Externalizing- t score	71.39	10.263	310

Correlations			
		TRSCIRT	Externalizing- t score
Trait	Pearson Correlation	1	.141 [*]
	Sig. (2-tailed)		.013
	N	310	310
Externalizing- t score	Pearson Correlation	.141 [*]	1
	Sig. (2-tailed)	.013	
	N	310	310

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix C – Correlation Analysis of Internalising Trait Scores and Internalising Subscale of TRF

Descriptive Statistics			
	Mean	Std. Deviation	N
Trait	.06	.729	310
Internalizing-t score	62.23	10.428	195

Correlations			
		TRSCIR T	Internalizing- t score
Trait	Pearson	1	.241**
	Correlation		
	Sig. (2-tailed)		.001
	N	310	195
Internalizing-t score	Pearson	.241**	1
	Correlation		
	Sig. (2-tailed)	.001	
	N	195	195

** . Correlation is significant at the 0.01 level (2-tailed).

**Appendix D – Correlation Analysis of Internalising Trait Scores and
Externalising Subscale of TRF**

Descriptive Statistics

	Mean	Std. Deviation	N
Trait	.06	.729	310
Externalizing-t score	67.39	10.955	195

Correlations

		TRSCIRT	Externalizing-t score
Trait	Pearson Correlation	1	-.042
	Sig. (2-tailed)		.559
	N	310	195
Externalizing-t score	Pearson Correlation	-.042	1
	Sig. (2-tailed)	.559	
	N	195	195

Appendix E – Correlation Analysis of Internalising Trait Scores and Number of Disorders.

Descriptive Statistics			
	Mean	Std. Deviation	N
Trait	.06	.729	310
No. disorders	1.7645	1.67198	310

Correlations			
		TRSCIRT	Ndisorders
Trait	Pearson Correlation	1	.950 ^{**}
	Sig. (2-tailed)		.000
	N	310	310
No. disorders	Pearson Correlation	.950 ^{**}	1
	Sig. (2-tailed)	.000	
	N	310	310

^{**}. Correlation is significant at the 0.01 level (2-tailed).